We Claim:

1. A method of operating a fuel cell having an anode, a cathode, a proton exchange electrolyte membrane interposed between the anode and cathode, and a separator having grooves formed in one surface thereof, said grooves extending straight continuously in completely spanning the one surface between opposing first and second ends thereof, the one surface being in contact with said cathode with said grooves open to and closed by said cathode, said method comprising:

supplying a first gas including hydrogen gas to the anode via a first gas flow passage;

supplying a second gas including an oxidizer to the cathode via a second gas flow passage inclusive of the grooves and separate from said first gas flow passage; and

spraying liquid water from at least one spray nozzle into the first ends of said grooves, into contact with a surface of said cathode and, in liquid state, out the second ends, thereby maintaining said electrolyte membrane in a moist condition.

2. A fuel cell operating method according to claim 1 further comprising detecting an output voltage of the fuel cell and controlling a quantity of water sprayed in response to the detected output voltage.

3. A fuel cell according to claim 1 further comprising calculating an optimum quantity of spray water as that quantity of spray water determined to maintain a proper moisture content within the electrolyte membrane and controlling the liquid water sprayed to provide the calculated optimum quantity of liquid water onto the surface of said cathode.

4. A fuel cell operating method according to claim 1 wherein said spraying is intermittent.

5. A fuel cell operating method according to claim 1 wherein the liquid water is sprayed directly onto the surface of said cathode.

6. A fuel cell operating method according to claim 1 wherein the liquid water is dispersed over the entire surface of the cathode.

7. A fuel cell operating method according to claim 1 further comprising calculating an optimum quantity of spray water as that quantity of spray water determined to maintain temperature of the fuel cell within a predetermined temperature range and controlling the spraying to spray the calculated optimum quantity of liquid water onto the surface of the cathode.

8. A fuel cell operating method according to claim 1 further comprising detecting power output of the fuel cell and controlling quantity of water sprayed responsive to the detected power output.

9. A fuel cell operating method according to claim 1 further comprising detecting power output of the fuel cell, calculating an optimum quantity of spray water based on the detected power output, and controlling the spraying to spray the calculated optimum quantity of liquid water onto the surface of the cathode.

10. A fuel cell operating method according to claim 1 wherein the water is sprayed at a predetermined constant pressure over a predetermined time interval.

11. A fuel cell operating method according to claim 1 wherein the electrolyte membrane has a thickness allowing water produced by fuel cell reaction at the cathode to permeate through the membrane toward the anode.

12. A fuel cell operating method according to claim 1 further comprising:

separating liquid water from gas exiting the second ends of the grooves.

13. A fuel cell operating method according to claim 12 further comprising recirculating the separated liquid water to the spray nozzle.

14. A fuel cell operating method according to claim 1 wherein said grooves are vertically oriented, said first ends are upper ends, and said second ends are lower ends, whereby said supplied water falls by gravity in traversing the grooves.